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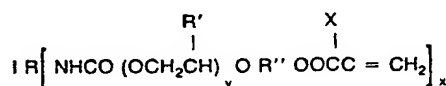
(N-Substituted carbamoyloxy)alkyleneoxyhydrocarbyl acrylate esters.

The present invention deals with (N-substituted carbamoyloxy) alkyleneoxy hydrocarbylacrylate esters and compositions containing the same and a photoinitiator.

The (N-Substituted carbamoyloxy) alkyleneoxy hydrocarbyl acrylate esters of the invention are produced by reacting an hydroxyalkyl acrylate with a vicinal alkylene oxide and capping the resulting adduct with an Isocyanat.

The resulting product is useful in ink, paint or adhesive formulations curable by thermal or radiation means.

The (N-substituted carbamoyloxy) alkylene-oxyalkyl acrylate esters of this invention are those defined by the structural formula:



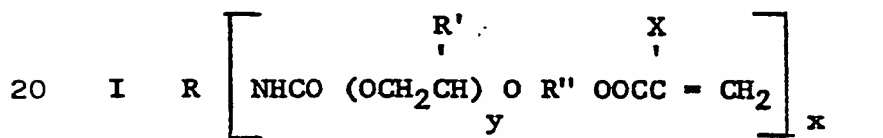
wherein R is a unsubstituted or substituted (i) linear or branched alkyl group having from 1 to 4 carbon atoms or (ii) aryl, alkaryl or aralkyl group having 6 or 10 ring carbon atoms or (iii) cycloalkyl group having from 5 to 8 ring carbon atoms, when x is 1, or (iv) polyvalent alkylene, arylene, alkarylene, aralkylene or cycloalkylene having carbone atom values defined for (i) to (iii) supra and a valence equal

to the value of x, when x is greater than 1; wherein the substituents on the R group are not reactive with the isocyanato radical; R' is hydrogen or alkyl having from 1 to 2 carbon atoms; R'' is a linear or branched divalent alkylene of 1 to 10 carbon atoms, preferably 2 to 4 carbon atoms, divalent cycloalkylene of 5 to 12 carbon atoms, preferably 6 to 8 carbon atoms, or divalent arylene of 6 to 10 ring carbon atoms; X is hydrogen, methyl or cyano; x has a value of from 1 to 4, preferably 1 or 2; and y is an integer having an average value of from 1 to 20, preferably from 1 to 6 and most preferably from 1 to 4.

(N-SUBSTITUTED CARBAMOYLOXY) ALKYLENEOXY HYDROCARBYL  
ACRYLATE ESTERS

The (N-substituted carbamoyloxy) alkyl acrylates,  
5 such as 2-(N-methyl carbamoyloxy) ethyl acrylate, are well  
known with the generic class disclosed in U.S. 3,479,328  
and U.S. 3,674,838. These compounds have been found parti-  
cularly effective in radiation curable compositions since  
10 they impart desirable properties to the prepared compos-  
itions and to the cured compositions. However, due to  
their sensitizing effect and toxicity they must be handled  
with extreme caution and, as a consequence, these features  
detract from their general acceptance and use.

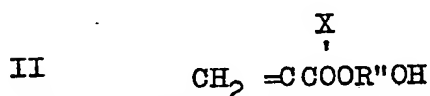
15 The novel (N-substituted carbamoyloxy) alkylene-  
oxyalkyl acrylate esters of this invention are those defin-  
ed by the structural formula:



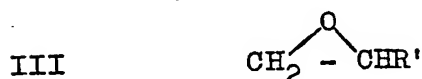
wherein R is an unsubstituted or substituted (i) linear or  
branched alkyl group having from 1 to 4 carbon atoms or  
(ii) aryl, alkaryl or aralkyl group having 6 or 10 ring  
25 carbon atoms or (iii) cycloalkyl group having from 5 to 8  
ring carbon atoms, when x is 1, or (iv) polyvalent alkyl-  
ene, arylene, alkarylene, aralkylene or cycloalkylene  
having carbon atom values defined for (i) to (iii) supra  
and a valence equal to the value of x, when x is greater  
30 than 1; wherein the substituents on the R group are not  
reactive with the isocyanato radical; R' is hydrogen or  
alkyl having from 1 to 2 carbon atoms; R'' is a linear or  
branched divalent alkylene of 1 to 10 carbon atoms, prefer-  
ably 2 to 4 carbon atoms, divalent cycloalkylene of 5 to  
35 12 carbon atoms, preferably 6 to 8 carbon atoms, or di-  
valent arylene of 6 to 10 ring carbon atoms; X is hydrogen,  
methyl or cyano; x has a value of from 1 to 4, preferably  
1 or 2; and y is an integer having an average value of  
from 1 to 20, preferably from 1 to 6 and most preferably  
from 1 to 4.

The novel compounds of this invention are produced, preferably, by a two-step process that can, if desired, be carried out sequentially in the same reactor. The compounds have monofunctionality when a monoisocyanate is used in the second step of the reaction and polyfunctionality when a polyisocyanate is used. The polyfunctional acrylyl compounds can be used as crosslinkers in formulated compositions.

In the first step of the reaction a hydroxyalkyl acrylate of the general formula:



wherein X and R'' are as previously defined, is reacted with a vicinal alkylene oxide of the general formula:



wherein R' is as previously defined, to produce the adduct.

Illustrative of suitable hydroxyalkyl acrylates or methacrylates or cyanoacrylates one can mention hydroxyethyl acrylate, hydroxyethyl methacrylate, hydroxyethyl cyanoacrylate, hydroxypropyl acrylate, hydroxybutyl acrylate, hydroxybutyl methacrylate, hydroxydecyl acrylate, hydroxydecyl cyanoacrylate, hydroxycyclohexyl acrylate, hydroxycyclohexyl methacrylate, hydroxycyclooctyl acrylate, and the like. Those skilled in the art are fully familiar with this class of compounds and mixtures can be used.

Illustrative of suitable vicinal alkylene oxides, one can mention ethylene oxide, propylene oxide, butylene oxide, or mixtures thereof; when mixtures are used they can be mixed at any proportions desired.

The reaction between the hydroxyalkyl acrylates and alkylene oxide is preferably carried out in contact with a catalyst. The Lewis Acids are suitable as catalysts and illustrative thereof are boron trifluoride etherate, antimony trifluoride, stannic chloride, zinc chloride,

as well as others known to those skilled in the art. The catalyst is present in a catalytically effective amount; this can be from 0.1 to 1 weight percent, based on the total weight of reactants charged, preferably from 0.2 to 0.5 weight percent, with from 0.25 to 0.35 weight percent most preferred.

5 In the reaction from 1 to about 80 moles, or more, preferably from 1 to 24 moles, of alkylene oxide are reacted per mole of hydroxyalkyl acrylate. The amount used is that required to give the desired average  $\gamma$  value in formula I; as previously indicated the preferred average  $\gamma$  value is from 1 to 6 and the most preferred value is from 1 to 4.

10 The reaction can be carried out at atmospheric or superatmospheric pressure; pressure is not critical though modest pressure is generally used when reacting an alkylene oxide, as is known in the art. The reaction time will vary dependent upon the particular reactants, catalysts, temperature, and batch size involved in any particular instance.

20 The reaction temperature will vary from about 20°C to about 125°C and is generally from about 25°C to about 80°C, preferably from about 55°C to 75°C.

25 To minimize olefinic bond free radical polymerization an inhibitor such as the monomethyl ether of hydroquinone may be present at a concentration of from about 0.01 to 1 weight percent. Any of the other known inhibitors can be used. It has been noted, however, that the inhibitors will also slow down the alkylene oxide addition reaction; therefore, when an inhibitor is used it should be employed at the lowest possible concentration.

30 In carrying out the first step, the reaction of the alkylene oxide with the hydroxyalkyl acrylate; one can charge the hydroxyalkyl acrylate and catalyst to a reactor equipped with stirring, condensing and cooling means and then the temperature of the contents is adjusted to the selected temperature. When this charge is at the desired temperature the alkylene oxide feed is started and cooling is supplied as required to maintain

the desired temperature during the exothermic feed period. After all of the alkylene oxide has been added, heating is continued for an additional period of time to assure completion of the reaction. The resulting adduct can  
5 be used in this form in the second step of the reaction, or it can be treated and the semi-refined or refined adduct can then be used in the second step of the reaction. The alkylene oxide can be reacted to produce a random, block or capped adduct by the procedures known  
10 in the art.

Any conventional refining procedure can be used when the adduct is desired in a purer state. Thus, following the additional heating period the residual adduct can be neutralized with a base or a diatomaceous  
15 earth material such as magnesium silicate, stirred, heated at reduced pressure to remove volatiles, and then filtered to remove solid residues. Other procedures can be used that are apparent to those skilled in the art.

In the second step of the reaction the adduct  
20 whose preparation was described above is reacted with an organic isocyanate. The suitable isocyanates can be mono-, di-, tri- or tetra-isocyanates and many such compounds are known and are commercially available. They can be used singly or in admixture and illustrative there-  
25 of one can mention methyl isocyanate, ethyl isocyanate, chloroethyl isocyanate, chloropropyl isocyanate, chlorohexyl isocyanate, chlorobutoxypropyl isocyanate, hexyl isocyanate, phenyl isocyanate, the o-, m-, and p-chlorophenyl isocyanates, benzyl isocyanate, naphthyl isocyanate, o-ethylphenyl isocyanate, the dichlorophenyl isocyanates, butyl isocyanate, n-propyl isocyanate, octadecyl isocyanate, 3,5,5-trimethyl-1-isocyanate-3-isocyanatomethylcyclohexane, di(2-isocyanatoethyl)-bicyclo(2.2.1)-hept-5-ene-2, 3-di-carboxylate, 2,4-tolylene diisocyanate, 2,6-tolylene diisocyanate, 4,4'-diphenylmethane diisocyanate, dianisidine diisocyanate, tolidine diisocyanate, hexamethylene diisocyanate, the m- and p-xylylene diisocyanate, tetramethylene diisocyanate, dicyclohexyl-4,4'-methane diisocyanate, cyclohexane-1,4-diisocyanate,  
35

1,5-naphthylene diisocyanate, 4,4'-diisocyanate diphenyl ether, 2,4,6-triisocyanato toluene, 4,4',4"-triisocyanatotriphenyl methane, diphenylene-4,4-diisocyanate, the polymethylene polyphenylisocyanates, as well as any of the other organic isocyanates known to the average skilled chemist.

It is customary to use any of the known urethane-forming reaction catalysts during the isocyanate reaction with the polyol. These are well known and any of the catalysts can be used. Illustrative thereof are dibutyltin dilaurate, stannous octoate, triethylenediamine, triethylamine, the known tin salt catalysts, and the like. They are generally employed at a concentration of from about 0.1 to 1 weight percent based on the weight of the reaction mixture.

The amount of isocyanate used is an amount to provide sufficient isocyanato equivalents to react with the reactive hydroxyl equivalents on the adduct. It is customary to use a slight excess to assure complete reaction. As previously indicated when a monoisocyanate is employed the novel N-(substituted carbamoyloxy)alkanoyloxyalkyl (or aryl) acrylate ester of formula I is monofunctional in respect to acrylyl functionality and when a polyisocyanate is used such formula I ester is polyfunctional in respect to acrylyl functionality. The term "acrylyl" includes acrylyl, methacrylyl and cyanoacrylyl groups.

The second step of the reaction is generally carried out by slowly adding the isocyanate to the adduct obtained in the first step of the reaction at a temperature of from about 20° to 90°C, preferably from about 25° to 75°C, and most preferably from about 40° to 55°C. During this addition the mixture is stirred; thereafter stirring is continued at the selected reaction temperature for a short period of time to assure completion of reaction. The residual product is then vacuum stripped to remove volatiles and, if necessary filtered to remove any trace quantities of solid particles. The N-(substituted carbamoyloxy)alkylene oxyalkyl acrylate

ester produced corresponding to formula I can be used per se or in formulated compositions useful as inks, coatings or adhesives.

5 In producing formulated compositions the novel compounds of this invention are compounded with activators or catalysts, photoinitiators or photosensitizers, pigments or colorants, solvents, other reactive components, etc. The formulators skilled in the art of inks, coatings and adhesives are fully familiar with the requirements  
10 in their respective fields and with the components used in such formulations. Such components can be formulated with the novel compounds of this invention by the known and conventional procedures and in the accepted concentrations.

15 Thus, when cure is to be accomplished by thermal means a conventional free radical catalyst or activator is used; when the cure is to be achieved by particulate radiation such as electron beam radiation, an activator is usually not required; when cure is to be effected  
20 by light radiation such as ultraviolet light, a photosensitizer or photoinitiator, with optionally an activator therefor, is needed to render the process commercially acceptable. Coating, ink or adhesive compositions can contain up to 100 weight percent, preferably from  
25 25 to 95 weight percent of the novel compounds of this invention as the reactive component thereof. The specific identities of the other components referred to in this and the preceding paragraph are well known to those skilled in the art and require no further  
30 elaboration herein to enable such person to produce the formulations.

The following examples serve to further illustrate the invention.

Example 1

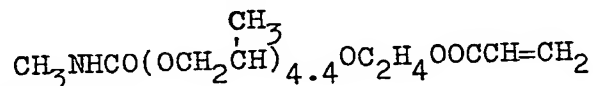
35 Step 1 - Production of 2-Hydroxyethyl Acrylate:Propylene Oxide Adduct

To a 1-liter stainless steel autoclave there was charged 120.8 grams (1 mole) of 2-hydroxyethyl acry-

late and 1.4 grams of boron trifluoride etherate catalyst. The feed of 348 grams (6 moles) of propylene oxide into this charge was begun at a temperature of 21°C. The reaction was strongly exothermic, requiring efficient cooling. The temperature was allowed to increase to about 50°C and the feed rate and cooling then adjusted to maintain a temperature of 55-60°C at a feed rate of about 60 grams per hour over the remainder of the five-hour feed period. When all the feed was in, the reactor showed a pressure of  $7 \times 10^3$  Pa; this fell to zero after one hour at 60°C. The temperature was then reduced to 50-52°C and a vacuum of  $0.26 \times 10^3$  -  $0.40 \times 10^3$  Pa (2-3 mm Hg) was applied for 0.5 hour to remove volatiles. The stripped product was treated for 2 hours at 70°C with 6.2 grams of magnesium silicate to neutralize catalyst residues. After filtration to remove neutralized catalyst residues and magnesium silicate there was obtained 316 grams of a clear, slightly yellow liquid having an hydroxyl number of 149.9 and a Brookfield viscosity of  $24.2 \times 10^{-6}$  m<sup>2</sup>/s at 38°C. According to the chemical end group analysis, the average add-on of propylene oxide was about 4.4 moles.

Step 2 - Production of (N-Methylcarbamoyloxy) polypropyleneoxyethyl acrylate

To a 500 ml amber glass kettle fitted with a stirrer, thermometer and feed tank there were charged 100 grams (0.27 moles) of the adduct of Step 1 and 0.15 gram of dibutyltin dilaurate catalyst. Over a period of 30 minutes at a temperature of 45-50°C a total of 15.7 grams (0.36 mole) of methyl isocyanate was fed in and then the mixture was heated for four hours at 50°C and then stripped free of volatiles for 1 hour at 45°C and  $2 \times 10^3$  Pa (15 mm Hg) pressure. The product was a very fluid, light yellow material having a residual isocyanato content of 0.11% by analysis and the average formula:



Example 2

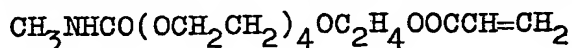
Step 1 - Production of 2-Hydroxyethyl Acrylate:Ethylene Oxide Adduct



To the same type equipment described in Step 1 of Example 1 there was charged a mixture of 241.6 grams (2 moles) of 2-hydroxyethyl acrylate, 2.8 grams of boron trifluoride etherate, and 0.21 gram of 2,6-di-tertiary butyl-p-cresol. Over a total of 4 hours there was fed into this charge 352 grams (8 moles) of ethylene oxide at a temperature maintained at 46-49°C by means of efficient cooling. After stirring another hour at 30°C, the charge was treated with 11.6 grams of magnesium silicate and stripped free of volatiles at full vacuum while holding the temperature at 70°C for two hours. After filtration there was obtained 519 grams of clear, water-white liquid having a viscosity of  $28 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and an hydroxyl number of 147.1

Step 2 - Production of (N-Methylcarbamoyloxy)polyethylenoxyethyl acrylate

In a manner similar to that described in Step 2 of Example 1, 300 grams of the above adduct and 0.45 gram of dibutyltin dilaurate catalyst were reacted with methyl isocyanate by feeding into the charge 45 grams of methyl isocyanate over a 20-minute period at 55°C. After a four-hour cookout at 45-49°C, the kettle contents showed no free isocyanate. A total of 320.5 grams of this product was stripped at 70°C for 1 hour at full vacuum on a Rotary Evaporator to afford 314 grams of product as a very mobile, light yellow liquid having a Brookfield viscosity of  $63 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and a Gardner color of 1.0 and the average formula:



Example 3

Step 1 - Production of 2-Hydroxyethyl Acrylate:Ethylene Oxide Adduct

In equipment and manner similar to that described in Step 1 of Example 1, 471.1 grams (3.9 moles) of hydroxyethyl acrylate, 4.2 grams boron trifluoride etherate and 0.32 gram of 2,6-di-tertiary butyl-p-cresol were reacted with 343.2 grams (7.8 moles) of ethylene oxide. There was obtained, after neutralization with 16 grams of magnesium silicate for 1.5 hours at 90°C, stripp-

ing at 90°C for 0.5 hour at full vacuum and filtration, 700 grams of clear, almost white liquid exhibiting an hydroxyl number of 218, which calculates to a molecular weight of 259. The product color was 1.0 Gardner and the Brookfield viscosity was  $18.2 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C. The adduct produced contained an average of two ethyleneoxy units.

Step 2 - Production of (N-Methylcarbamoyloxy)polyethyleneoxyethyl acrylate

In a manner similar to that described in Step 2 of Example 1, the above adduct was reacted with mono-isocyanate by feeding 66 grams of methyl isocyanate to a mixture of 300 grams of the adduct and 0.45 gram of dibutyltin dilaurate catalyst. After reaction and stripping at 70-75°C at  $0.65 \times 10^3 \text{ Pa}$  (5mm Hg) pressure, there was obtained 361 grams of a liquid product having a Gardner color of 1, a Brookfield viscosity of  $36.6 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and a free isocyanato content of 0.01%.

In a similar manner the adduct of Step 1 is reacted with tolylene diisocyanate or hexamethylene diisocyanate to produce the corresponding diacrylate compounds.

Example 4

Step 1 - Production of 2-Hydroxyethyl Acrylate:Ethylene Oxide Adduct

In a manner similar to that described in Step 1 of Example 1, 300 grams (3.9 moles) of 2-hydroxyethyl acrylate was reacted with 10.7 moles of ethylene oxide in the presence of 4.2 grams of boron trifluoride etherate and 0.32 gram of 2,6-di-tertiary butyl-p-cresol. There was recovered after neutralization, stripping and filtration 830 grams of water-white liquid adduct having an hydroxyl number of 201, a specific gravity of 1.129 at 25°C and an average of three ethyleneoxy groups.

In a similar manner the adduct is produced using 2-hydroxypropyl acrylate or methacrylate or 4-hydroxycyclohexyl acrylate in place of the 2-hydroxyethyl acrylate.

Step 2 - Production of (N-Methylcarbamoyloxy)polyethylene

oxy ethyl acrylate

In a manner similar to that described in Step 2 of Example 1, 300 grams of the adduct of Step 1 was reacted at 45-50°C. with 61.3 grams of methyl isocyanate in the presence of 0.45 grams of dibutyltin dilaurate catalyst. There was obtained 355 grams of stripped product as an almost colorless liquid having a specific gravity of 1.057 at 20°C, a Gardner color 1.0, a Brookfield viscosity of  $45.6 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and a free isocyanato content of 0.01%; it contained an average of about three ethyleneoxy units.

Example 5

Step 1 - Production of 2-Hydroxyethyl Acrylate:Propylene Oxide Adduct

In a manner similar to that described in Step 1 of Example 1, 2 moles of 2-hydroxyethyl acrylate was reacted with 4 moles of propylene oxide in the presence of 2.8 grams of boron trifluoride at 45-48°C. There was obtained 444 grams of neutralized, stripped and filtered liquid product having Gardner 1.0 color, Brookfield viscosity of  $11.7 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and an average of two propyleneoxy units.

In a similar manner the adduct is produced using a mixture of ethylene oxide and propylene oxide.

Step 2 - Production of (N-Methylcarbamoyloxy)polypropyleneoxyethyl acrylate

In a manner similar to that described in Step 2 of Example 1, 244 grams of the adduct of Step 1 was reacted with 62.6 ml. of methyl isocyanate at 45-50°C using 0.35 gram of dibutyltin dilaurate catalyst. After a four hour reaction at 45-50°C and a one hour vacuum stripping ( $0.65 \times 10^3 \text{ Pa}$  or 5mmHg) at 50°C, 297 grams of liquid, capped product was obtained with a specific gravity of 1.099 at 25°C, a color of 1 Gardner, a Brookfield viscosity of  $34.1 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C, a free isocyanato content of 0.01% and an average of about two propyleneoxy units.

Example 6

Step 1 - Production of 2-Hydroxyethyl Acrylate:Propylene

# Oxide Adduct

In a manner similar to that described in Step 1 of Example 1, an adduct was prepared by feeding 8 moles of propylene oxide to a mixture of 2 moles of hydroxyethyl acrylate in the presence of 2.8 grams of boron trifluoride etherate. The feed time required was one hour at 44-48°C. The recovery of neutralized, stripped product was 638 grams; it had a Gardner color of 1, a Brookfield viscosity of  $17.4 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C and an average of about four propyleneoxy units.

## Step 2 - Product of (N-Methylcarbamoyloxy)polypropyleneoxyethyl acrylate

In a manner similar to that described in Step 2 of Example 1, 300 grams of the adduct of Step 1 above was reacted with 51.3 ml of methyl isocyanate in the presence of 0.45 gram of dibutyltin dilaurate catalyst at 45-50°C. The stripped product (341 grams) exhibited a specific gravity of 1.074 at 25°C, a color of 1 Gardner and a Brookfield viscosity of  $46.6 \times 10^{-6} \text{ m}^2/\text{s}$  at 38°C. The residual free isocyanato content was 0.008%; it had an average of about 4 propyleneoxy units.

A series of curable compositions was prepared using the reactive novel (N-alkylcarbamoyloxy)polyalkyleneoxyalkyl acrylates produced in Examples 3 to 6. The compositions were prepared by producing an acrylated polyester urethane oligomer in the reactive novel acrylates produced in Step 2 of the above examples as the solvent medium for the oligomer formation reaction. The procedure followed was to initially charge 17.3 g of the reactive novel acrylate of this invention as reactive solvents, 2 drops of dibutyltin dilaurate catalyst and 14.7 g of isophorone diisocyanate to a reactor and then heat the mixture to 50°C. To this mixture there was slowly added 17.6 g of polycaprolactone diol having an average molecular weight of 530 followed by the slow addition of 8 g of 2-hydroxyethyl acrylate; the temperature was maintained at about 50°C. After all of the reactants had been added, the mixture was stirred to assure completion of the reaction (Runs 1 to 4). For comparative purposes a simi-

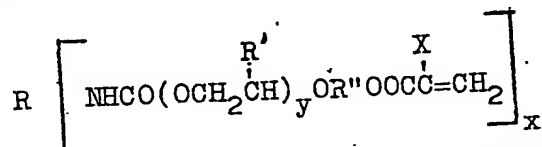
lar composition was produced by the same process using 17.3 g of 2-ethylhexyl acrylate (2-EHA) as the reactive solvent (Run 5). To each composition there was also added 0.01 g of monomethyl ether of hydroquinone as inhibitor and 0.6 g of di-sec-butoxyacetophenone as photo-initiator.

The liquid compositions were applied to steel panels and cured by exposure to ultraviolet light radiation in a nitrogen atmosphere. The dry, cured films were removed from the panels and evaluated. The data revealed that the compositions containing the reactive novel acrylates of this invention produced films having significantly superior tensile properties than film obtained using the commercial reactive monomer solvent employed in Run 5. Further, the reactive novel acrylates of this invention are less volatile, cure more rapidly and exhibit less odor, all significant economic and environmental considerations. The results of this series are reported in the following table; tensile and elongation were measured using ASTM-D-638.

Run	Source of Reactive Solvent	Films Thickness (mm)	Tensile Strength, (Pa)	Elongation %
1	Example 3	$81 \times 10^{-3}$	$27.6 \times 10^5 \pm 2.5 \times 10^5$	$33 \pm 5$
2	Example 4	$86 \times 10^{-3}$	$26.9 \times 10^5 \pm 2.4 \times 10^5$	$33 \pm 4$
25	3 Example 5	$137 \times 10^{-3}$	$46.9 \times 10^5 \pm 9.6 \times 10^5$	$47 \pm 8$
	4 Example 6	$155 \times 10^{-3}$	$34.5 \times 10^5 \pm 4.1 \times 10^5$	$39 \pm 5$
	5 2-EHA (Control)	$104 \times 10^{-3}$	$17.9 \times 10^5 \pm 6.8 \times 10^5$	$33 \pm 8$

CLAIMS

1. An (N-substituted carbamoyloxy)alkyleneoxy-hydrocarbyl acrylate ester of the formula:



wherein R is an unsubstituted or substituted (i) linear or branched alkyl group having from 1 to 4 carbon atoms or (ii) aryl, alkaryl or aralkyl group having 6 or 10 ring carbon atoms or (iii) cycloalkyl group having 5 to 8 carbon atoms; when x is 1, or (iv) polyvalent alkylene, arylene, alkarylene, aralkylene or cycloalkylene having carbon atom values defined for (i) to (iii) supra and a valence equal to the value of x, when x is greater than 1; wherein the substituents on the R group are not reactive with the isocyanato radical; R' is hydrogen or alkyl having from 1 to 2 carbon atoms; R'' is a linear or branched divalent alkylene of 1 to 10 carbon atoms, divalent cycloalkylene of 5 to 12 carbon atoms or divalent arylene of 6 to 10 ring carbon atoms; X is hydrogen, methyl or cyano; x has a value of from 1 to 4; and y has an average value of from 1 to 20.

2. A compound as claimed in claim 1, wherein R' and X are hydrogen; R'' contains from 2 to 4 carbon atoms and y has an average value of from 1 to 6.

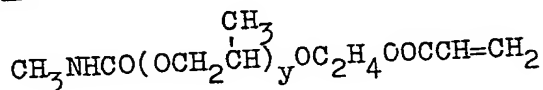
3. A compound as claimed in claim 2, wherein R' is methyl.

4. A compound as claimed in claim 2, wherein x is one.

5. A compound as claimed in claim 3, wherein X is one.

6. A compound as claimed in claim 1, wherein x is two.

7. A compound as claimed in claim 1 of the formula:



or of the formula:

$$\text{CH}_3\text{NHCO}(\text{OCH}_2\text{CH}_2)_y\text{OC}_2\text{H}_4\text{OOCCH}=\text{CH}_2$$
  
wherein y is as defined in claim 1.

5        8. A compound as claimed in claim 1, wherein both ethyleneoxy and propyleneoxy groups are present in the molecule.

9. A compound as claimed in claim 1, wherein R is the divalent tolylene group and x is two.

10       10. A composition comprising a compound as claimed in anyone of claims 1 through 9 and a photoinitiator.



European Patent  
Office

# EUROPEAN SEARCH REPORT

0036813  
EP 81 40 0437

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	GB - A - 1 443 715 (KANSAI PAINT CY)  * Claims; examples *  -----	1-10	C 07 C 125/06 C 08 G 18/67 C 09 J 3/16 C 09 D 3/48
			TECHNICAL FIELDS SEARCHED (Int. Cl.)
			C 07 C 125/06
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 01-07-1981	Examiner GAUTIER



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